Logging System Planning

The successful implementation of any specialized logging system is dependent upon successful planning. With a specialized logging system, it is possible to do a more efficient job under particular conditions. The key to logging planning is to keep the specialized logging system working in its particular niche. If the logging system is applied in conditions for which it is not suited, harvesting costs and adverse environmental impacts will likely be high. An example is the application of mechanical felling. It is well known that mechanical felling is safer, more productive and less expensive than manual felling; however, there are certain slope and tree size limitations to mechanical felling equipment. As an example: a logger buys a mechanized feller but can only use it 50% of the time because the tracts are too steep or the timber too large. The costs are effectively doubled because the risk of accident is high and productivity suffers when the machine is pushed on slopes beyond its effective working range to increase utilization. As a rule, mechanical felling is better than manual felling–*in its niche*. Keeping the specialized tool in its niche is what logging planning is all about–knowing well ahead of the scheduled harvest what logging system is needed and if there is enough timber to keep it utilized. Logging plans are done at different scales, to serve different purposes, and are typically referred to as *strategic* and *tactical* logging plans.

Strategic Logging Plans – These involve large areas on numerous tracts and are based heavily on topographic maps with fieldwork verifying only critical items. A paper logging plan is designed, showing landing locations, road locations, logging systems and yarding patterns. This paper plan is then reviewed in the woods to verify questionable locations such as access points and major road locations and is adjusted accordingly. In this fashion, different logging systems can be evaluated for their environmental impacts and cost of harvesting. An example of such evaluations is comparing the conventional cable skidder to cable logging on steep ground. The results of this comparison might reveal that the impacts and costs of building extensive skid road networks for the skidder would create more impacts and cost more than cable logging. Additionally, the capacity of the cable system would be identified, such as how much uphill, sidehill, and downhill yarding is required. How far will the cable system need to yard? On what type carrier should the yarder be in order to negotiate the landing settings? What size lines should the yarder run and how tall a tower is needed? Following strategic logging planning that represents the variety of timber and terrain being harvested, patterns develop and lead to logging system equipment selection.

Tactical Logging Plans – These involve specific tracts with specific logging systems and are field verified to the extent that the plan can be implemented as designed with acceptable environmental impacts, and within the harvesting cost budgeted for the tract. This is the plan that the selected logging contractor can take to the woods, with their particular equipment, and build the roads where shown, and log with the patterns shown, at the cost that has been planned. Having an accurate logging plan allows the contractor to schedule the work efficiently and avoid unknown surprises. As logging system specialization occurs, tracts will need to be subdivided for the logging contractor who has the system to fit the timber and the terrain. This could mean, for example, reserving a strip of selective harvest along a residential development for a horse-logging contractor (or small selective cut contractor), while the remainder of the tract is reserved for a fully mechanized, high-production clear cutting contractor. In the mountains it will mean separating the tract between the specialized cable logger from a conventional skidder logger. *By tactically identifying each logging systems niche, and planning to fit the specialized system to the timber and terrain, a reduction in both the harvesting costs and environmental impacts can be achieved.*

Conclusion

Effective BMP implementation for timber harvesting operations needs to consider appropriate logging systems selection and logging plans. The utilization of specialized logging systems can result in lower costs and lower environmental impacts when compared to a one-size-fits-all harvesting operation. Logging planning is essential to the successful implementation of specialized logging systems and the effective implementation of BMPs.

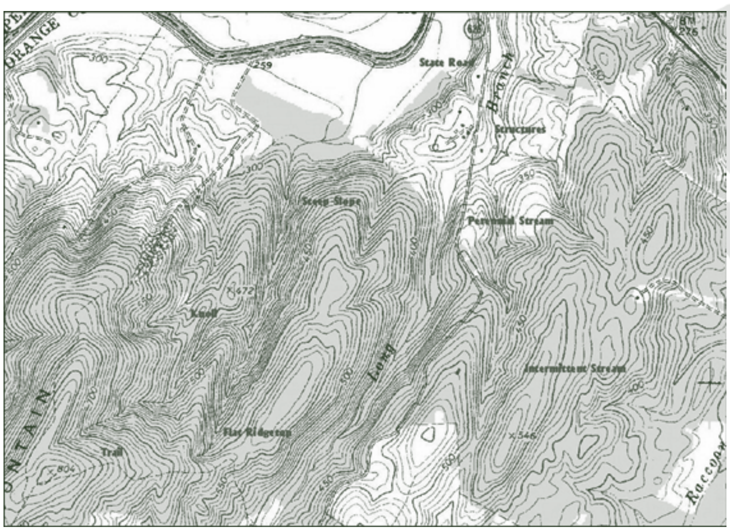
Streamside Management Zones

Streamside Management Zones (SMZs) are areas adjacent to streams that protect water quality. They may have other names such as *riparian areas* or *buffer strips*. Whatever the name, these areas are extremely important to the protection of water quality. An effective SMZ will filter sediment and nutrients, maintain desirable water temperatures, and provide many of the essential requirements of forest stream ecosystems.

Note that on all harvest operations that take place in Tidewater Virginia, all necessary Forestry BMPs must be implemented properly according to the Chesapeake Bay Preservation Act. The SMZ is one such BMP and must be left according to the specifications in this section. If a proper SMZ is not left, it is considered a violation of the Chesapeake Bay Preservation Act. The enforcement procedure is outlined in Chapter 10.

The first step in delineating SMZs is to identify the perennial and intermittent streams on the property. Other significant waters such as lakes, ponds, natural springs, and municipal water supplies will also merit a SMZ. A perennial stream is one that holds water throughout the year except during periods of extreme drought. An intermittent stream is one that holds water during seasonally wet times of the year.

A 1:24,000 USGS topographic map is a good starting point for identifying the major perennial and intermittent streams. Perennial streams are designated as a solid blue line. Intermittent streams are shown with a dotted blue line. It must be remembered that many intermittent streams that are not shown on the topographic map merit an SMZ. Identifying characteristics of an intermittent stream include a defined channel, evidence of streambed scouring, and bare soil or rock showing on the streambed bottom.



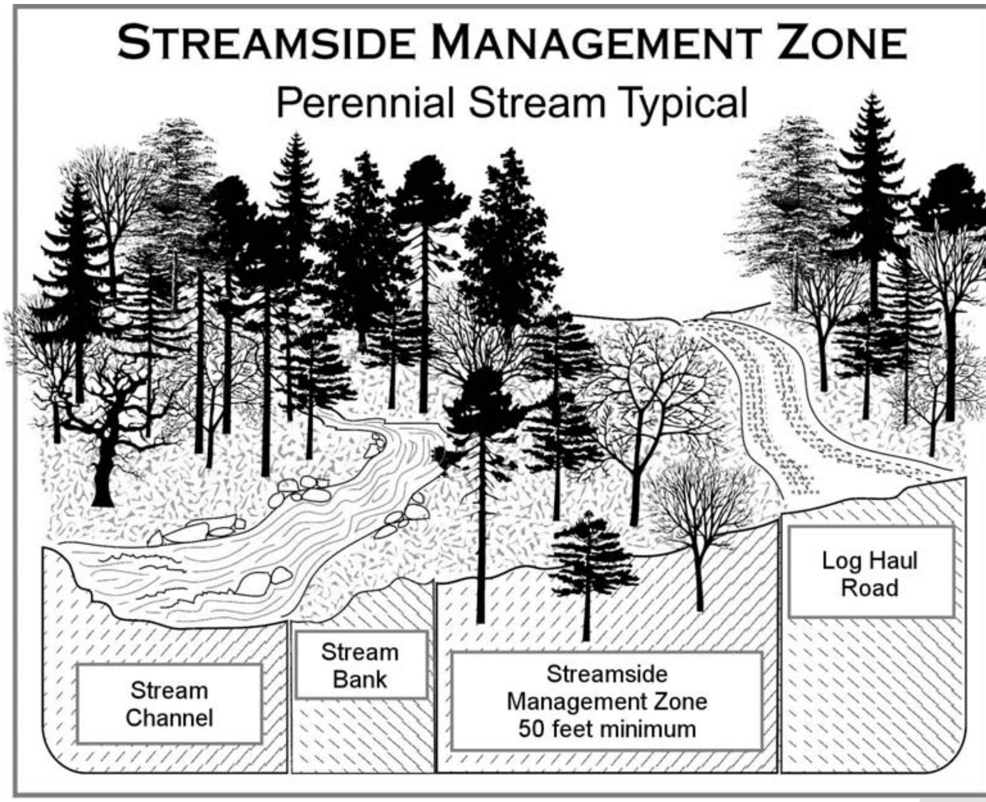
It is recommended that all SMZs be a minimum of 50 feet in width, measured from the top of the stream bank. This 50-foot SMZ is a managed forest; within this managed area up to 50 percent of the basal area or up to 50 percent of the forest canopy can be harvested.

Tidal streams are unique in that they often encompass wide areas of adjacent grasslands. For the purposes of establishing SMZ width, measure from the edge of the grassland/woodland area. The goal is to have at least 50 feet of undisturbed vegetation between the edge of the grassland area and the timber harvest area. Land immediately adjacent to the tidal marsh should not be disturbed by equipment.

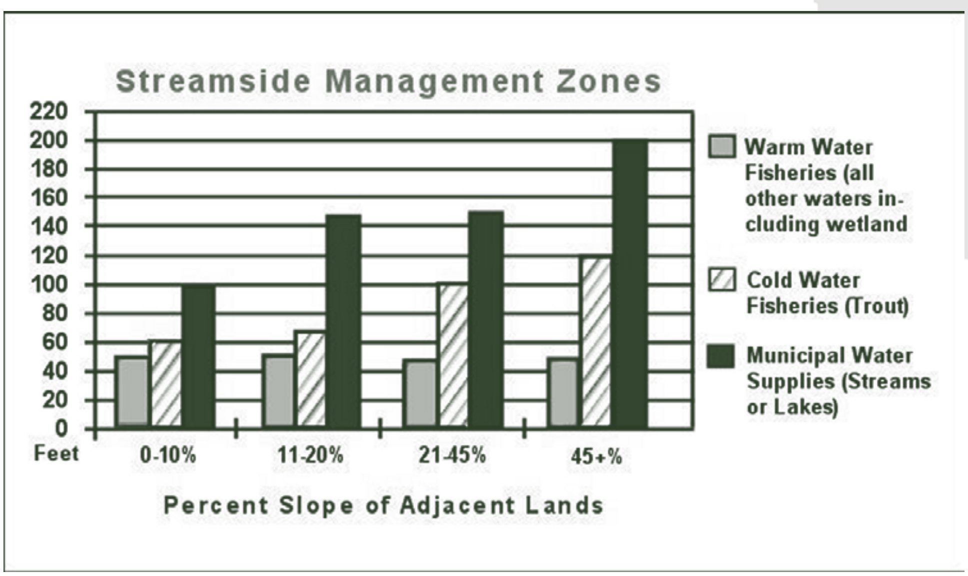
Some streams in Virginia flow into caves in areas where karst geology exists. It is important to treat these cave entrances with an appropriate 50-foot SMZ.

The photo below shows a proper SMZ. Please notice the continuity of the SMZ up and down the stream channel. *Partial clear-cutting of the SMZ should be avoided.* It is not desirable to have large fluctuations in SMZ width in an attempt to reach the average of the desired width.

Harvesting within the SMZ should minimize disturbance. The forest floor should remain essentially undisturbed. Manual felling, directional felling, and mechanized felling can be effectively used providing minimal disturbance of the forest floor results. Drainage structures such as ditches, water bars, broad-based dips and culverts should be used on skid trails and haul roads prior to entrance to the SMZ. Locate all decks and sawmill sites outside the SMZ. On tracts where this is not possible, additional practices may be necessary to protect water quality.



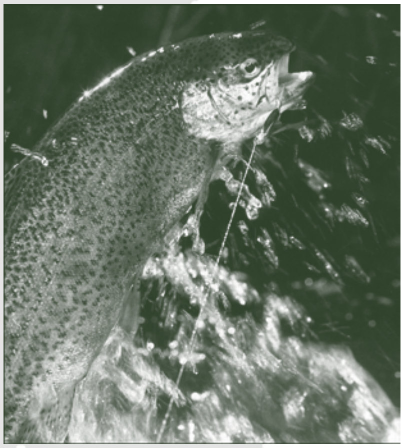
Steep slopes, cold-water fisheries, and municipal water supplies all need wide SMZs to protect water quality. The following table lists the widths for streamside management zones for streams in conjunction with different stream types.



SMZs for Trout

It should be noted in the previous table that coldwater fisheries (trout) require a wider SMZ than warm water fisheries. A wider SMZ is more effective at reducing sedimentation, maintaining lower water temperatures through shading, and introducing food such as leaves and insects into the food chain. Ninety percent of the food in forested streams comes from bordering vegetation.

Wild trout populations require cold, well-oxygenated water, a clean stream bottom, and good fish cover. An overhead cover such as undercut banks, large rocks, or submerged logs is required. When such cover is removed, the trout leave. Lack of suitable cover limits the number of large trout a stream can support. In Virginia, most trout habitat losses occur through increased stream temperature, siltation and stream channel alteration.



Water temperature may be the most critical factor facing Virginia's trout populations. Most shaded mountain streams do not exceed 70°F during the summer, which is suitable for trout. Aquatic habitat and suitable water temperature can be maintained even during logging operations when streamside vegetation is left intact. In most cases, maximum stream temperatures in the low 70s are within the tolerable range for trout, but such temperatures improve the habitat for other stream fishes against which trout cannot compete.

Silted stream bottoms also decrease the stream's insect population, an important source of food for trout. Siltation also makes trout reproduction difficult.

Trout lay eggs in stream gravel and clean gravel is necessary to insure movement of oxygenated water over the eggs. As little as a quarter-inch of silt over trout eggs can result in 100 percent mortality.

The Department of Game and Inland Fisheries' trout stream inventory identifies over 2,300 miles of wild trout streams in Virginia. Biologists are encouraged to find that brook trout–the only trout species native to Virginia–still account for 80 percent of the wild trout resource in the state.

Salvage and Sanitation in the SMZ

The necessity to remove and utilize forest products that have been damaged by insects, disease or other factors is important to the health of adjacent timberlands. Factors that need to be considered for salvage and sanitation within the Streamside Management Zone are: 1) potential threat to neighboring forest resources; and 2) alternatives for insect and disease control strategies that may be more economical with less potential for site damage.

It is important to weigh all factors related to the salvage and sanitation operation and to minimize the potential impact to water quality when operating within the SMZ. This can be accomplished by:

1. Locating haul roads and skid trails outside the SMZ.

2. Harvesting of areas adjacent to the SMZ to remove potential brood trees, susceptible species, low-vigor trees and high-quality stems at or near maturity.

3. Removal of harvested timber in the SMZ should be done so that the forest floor remains virtually undisturbed. If disturbance does occur, a permanent vegetative cover should be established on exposed soil within the SMZ.

4. Equipment should not be operated in or adjacent to the SMZ for salvage and sanitation purposes when soils are saturated.

5. When more than 50% of the basal area is removed, evaluate the density of the understory and importance of stream temperature to determine the need for revegetation or reforestation.

6. Small spots of damage–less than one acre–may be completely harvested.

When a salvage/sanitation harvest within the SMZ occurs within an area of the state that falls within the guidance of The Chesapeake Bay Preservation Act (CBPA), notify the locality and the local contact for The Chesapeake Bay Local Assistance Department of the intent to harvest a portion of the SMZ. The reason should be documented as salvage/sanitation for forest health.

Debris in Streams

Significant logging debris should be kept out of streams. Logging debris can change the flow of water and cause stream bank erosion. A large amount of green logging debris in a stream can cause oxygen depletion and kill fish. Trash, logging debris, tree limbs or tops cannot block the passage of fish or boats. The Department of Forestry has been given the responsibility for enforcement of the Debris in Streams Law, Section 62.1-194.2, *Code of Virginia*. A copy of this regulation may be found in Chapter 10.

Stream Crossing Design and Construction

Stream crossings are the point at which the haul road or skid trail intersects a stream channel. The manner and construction of a road or skid trail crossing a stream is extremely important and is where most logging water quality problems occur. Stream crossings have the potential to adversely affect water quality by exposing soil at or near a stream channel. Stream crossings should be avoided whenever possible through proper pre-harvest planning. Permits may be required from the Virginia Marine Resources Commission, local government, and/or the Army Corps of Engineers for permanent culvert installations.

If a stream crossing is necessary through pre-harvest planning, one must consider three basic types of crossings: bridges, culverts and fords.

Temporary Bridges

Bridges are the preferred method of crossing streams because they require little or no instream work to install. They typically require less time to install and can be used many times making them more cost-effective than culverts. Furthermore, bridges have less effect on fisheries than other stream crossing methods. Pole bridges may also be used for temporary crossings under certain conditions. *Any bridge installed for use by the general public for public transport should be designed by a licensed civil engineer.*

Temporary Bridge Specifications

1. Temporary bridges should be installed at right angles to the stream.

2. Bridges should be of sufficient length to maintain at least 5 feet of bridge/ground contact on each side of the stream (this will vary depending on bridge design).

3. Mud sills consisting of rough sawn hardwood beams 16 inches wide, three inches thick and 16 feet long can be used to provide additional load bearing capacity in soft soil conditions.

4. As with culverts, the approaches should be stable. Stabilize approaches with rock (in the case of haul roads), brush, corduroy with poles (in the case of skid trails) or other non-erodible surface extending at least 50 feet from both sides of the stream edge. Ideally, the non-erodible surface would extend to the top of the hill on each side of the stream approach.

5. Bridge approaches should be straight to limit safety hazard and prevent logs, soil, and other debris from being deposited into the stream by the sliding movement of logs over the edge of the bridge. As with temporary culverts, remove temporary bridges when logging is completed. Stabilize approaches and stream edges by installing the appropriate number of water control structures and establish vegetation to prevent soil delivery to stream.

Prompt stabilization after removal of the bridge will be most critical to the protection of water quality.

Pole Bridges

Pole bridges may be used when crossing a stream channel where no water is present. Pole bridges are wood logs of no less than 10 inches in diameter packed in a stream channel creating a solid foundation on which to skid. This structure may incorporate the use of heavy gauge steel pipe (no specific diameter requirement) with the logs to allow for short periods of flow should it rain. Pole bridges should not be used on channels greater in width or depth than the diameter of the skidder tire.

Pole bridges can be used in dry, intermittent stream channels for a short period of time. Pole bridges should be removed immediately following their use.

Pole Bridge Specifications

1. Pole bridges should be packed sufficiently so as not to allow the skidder to dip below the streambank edge and cause erosion.

2. A heavy-gauge steel pipe incorporated in the channel with the logs will help in the event an unforeseen rainfall event occurs while the structure is in place.

3. Pole bridges should not have any dirt or debris associated with the logs. Pole bridges must be removed following logging. As with temporary culverts, pole bridges are considered a water quality problem if not removed.

4. Stabilize the approaches to the pole bridge location following logging with the appropriate number and type of water control structures and establish rooted vegetation.